

# Multilayer Polymeric Shielding to Protect Humans from Galactic Cosmic Radiation, Phase II

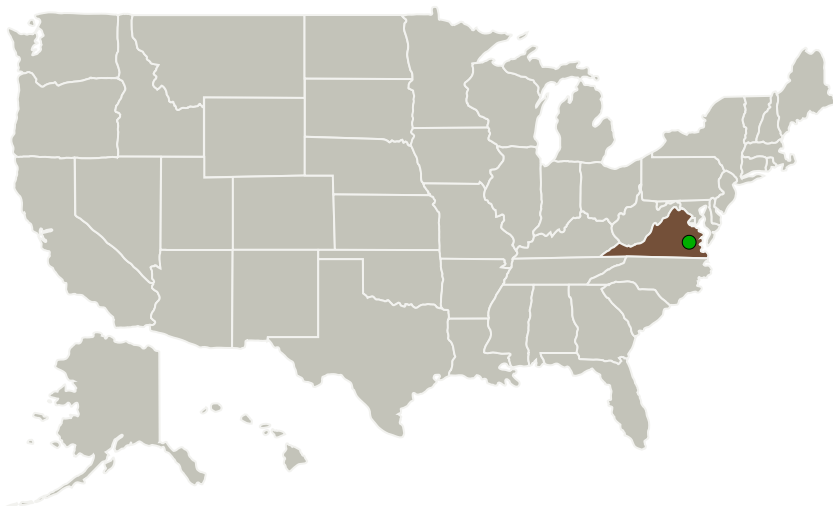
Completed Technology Project (2011 - 2013)



## Project Introduction

In Sub-topic X4.01, NASA has identified a need for advanced radiation-shielding materials and structures to protect humans from the hazards of galactic cosmic radiation (GCR) and Solar Energetic Particles (SEP) on long-duration missions, outside the earth's magnetosphere. The radiation species of greatest interest are light ions (particularly protons), heavy ions (such as iron-56) and neutrons. International Scientific Technologies, Inc., in conjunction with the College of William and Mary, in its Phase I program developed lightweight, multi-layered, polymeric shielding against GCR and SEP. The Phase II objectives include analysis and design of single and multi-layered nanocomposite polymeric radiation shields using OLTARIS modeling protocols to supplement the empirical results of Phase I, fabrication of nanocomposite films and multi-layered structures, acquisition of families of test data to determine key parameters of single and multi-layered structures tailored to stopping GCR and SEP, optimization of prototype multi-layered polymeric shields using statistical design and OLTARIS modeling for a range of manned and unmanned NASA applications prior to commercialization in Phase III. The anticipated result of the Phase I and Phase II programs is the development of multi-layered shields with an outer layer of hydrogenous polymeric material for significant dose reduction of incident GCR ions and inner layers of polymeric composites containing additives chosen to moderate and absorb neutrons resulting from fragmentation of incoming heavy ions and to absorb short wavelength electromagnetic radiation resulting from the slowing of the GCR particles and capture of neutrons. The Technology Readiness Level (TRL) at the beginning of Phase II is 4. At the end of Phase II, the TRL will be 5.

## Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
International Scientific Technologies, Inc.	Lead Organization	Industry	Dublin, Virginia
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

## Primary U.S. Work Locations

Virginia

## Project Transitions

**June 2011:** Project Start**July 2013:** Closed out

### Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/139150>)

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

International Scientific Technologies, Inc.

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Principal Investigator:

Russell J Churchill

### Co-Investigator:

Russell Churchill

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## Technology Maturity (TRL)

Start: 4  
Current: 5  
Estimated End: 5



## Technology Areas

### Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - └ TX12.1 Materials
    - └ TX12.1.6 Materials for Electrical Power Generation, Energy Storage, Power Distribution and Electrical Machines

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System